قسم طب الحيوان
كلية الطب البيطري - جامعة الاسكندرية
رئيس القسم : أ٠د/ متولي الشناوي

بعض التغيرات البيوكيميائية في الخراف الهزيلة التي تعاني من نقص عنصر النحاس

محمود اسماعيل ، صبحي المغاوري ، ابراهيم عاشور ، عبدالرحيم الغنام

تم في هذا البحث تسجيل العلاقات الاكلينيكية وكذلك التغيرات البيوكيميائية في الخراف الهزيلة والتي تعاني من نقص النحاس ٠

وقد تبين أن هناك نقصا ملحوظا في مستوى عنصر النحاس ، وكذلك في مستوى نشاط خميرة السيرلوبلازمين في الحيوانات المريضة وقد لوحظ أن هناك ارتباط قوي (ر = ٩٧٣ر٠) بين عنصر النحاس ونشاط خميرة السيرلوبلازمين ، مما يوضح مدى الاستفادة من قياس نشاط هذا الانزيم كبديل لتعيين مستوى عنصر النحاس في مصل الدم ٠

Dept. of Animal Medicine,
Faculty of Vet. Med., Alex. University,
Head of Dept. Prof. Dr. M.M. El-Shinnawi.

SOME BIOCHEMICAL ALTERATIONS IN UNTHRIFTNESS SHEEP SUFFERING FROM COPPER DEFICIENCY

(With 1 Table & 1 Fig.)

By
M. ISMAIL; S. EL-MAGAWRY*; I.A. IBRAHIM** and A.A. EL-GHANAM**

(Received at 21/9/1987)

SUMMARY

In this work, the clinical signs and some biochemical alterations of unthrifty sheep suffering from hypocuprosis as will as clinically healthy one were recorded. The diseased sheep were hypocupraemic in comparison with control group. The mean values of blood serum copper and caeruloplasmin of diseased sheep were 130.85±8.42 mg% and 80.75±0.58 U/L., respectively.

Strong positive correlation (r=0.973) was obtained between blood serum copper level and caeruloplasmin activity, indicating the usefullness of the activity of this enzyme as an alternative assay for copper deficiency.

INTRODUCTION

Copper is an essential nutrient for cattle and sheep. Signs of copper deficiency include poor growth, diarrhoea, unthriftiness loss of hair and wool colour, as will as, enzootic ataxia in suckling lambs and foetal resorption (POOLE, 1963 and UNDERWOOD, 1977). The nutrtional requiement of copper is 10 mg/kg. (National Research Council, 1978), but a conditioned copper deficiency can occur in ruminants when uptake nad utilization of copper are distributed by other substances in hte diet, such as molbdenum and sulphur (SUTTLE, 1974 and DICK, et al. 1975) which reduce the availability of dietary copper due to the formationofthimolybdates in the rumen, which decrease its avaliability and impede its absorption and metabolism.

Activities of microelment-dependent enzyme have been used as alternatives to direct measurments of blood serum trace mineral concentrations. Caeruloplasmin has been as a copper dependent enzyme and to indicate plasma copper concentrations (PAYNTER, 1982 and KINCAID, et al. 1986).

The purposes of the present study were to investigate the copper dificiency in unthrift sheep and the usefullness of blood serum caeruloplasmin activity as an indicator of copper concentration in sheep.

* Dept. of Animal Medicine, Fac. of Vet. Med., Zagazig Univ.
** Dept. of Biochemical, Fac. of Vet. Med., Suez Canal Univ.

MATERIAL and METHODS

Animals:

Thirty-five ewes, 1-3 years old, presented to veterinary medical faculty of Edfina, Alexandaria University, were used in this study. Ten ewes were used as control. These ewes were suffered from unthriftiness, depraved appetite and weaknes. Wool abnormalities were observed and recorded, including losses of wool crimp with steely appearence and loss of its colour. Some of them showed easily dectachable wool with areas of alopecia, while some showed persistent diarrhoea in the form of watery, yellow-green to black faeces.

Faecal examination for the detection of ova of internal parasites was done using direct smear and the flotation technique a after SONNENWIRTH and JARETT (1980).

Blood samples:

Blood samples were drawn from the jugular vein into evacuated blood serum collection tubes, designed to minimize trace elements contamination. Blood was centrifugated and serum was collected into vials and frozen untill used. All haemolysed samples were discarded.

Non haemolysed blood serum samples were used for estimation of copper, iron, caeruloplasmin, calcium, and inorganic phosphrous according to the methods of ZAK (1958); PICCARDI, et al. (1972), SCHOSINSKY, et al. (1974), GENDLER and KING (1972) and FISH & SUBBAROW (1925); respectively.

Statistical analysis of data for analysis of variance and polynomial regression coefficient was applied after SNEDECOR and COCHRAN (1980).

RESULTS

The clinical signs observed in the diseased ewes were in the form of unthriftiness depraved appetite and weakness, as will as wool abnormalities including loss of wool crimp, loss of colour with steely appearence. Some of diseased ewes showed easily detechable wool, with areas of alopecia, while some showed persistent diarrhoea with the passage of watery, yellow-green to black faeces. Faecal examination revealed highly parasitic infestation of diseased ewes.

Table (1) and Fig. (1) showed the result of blood serum analysis for copper, caeruloplasmin activity, iron, calcium and phosphorus, as well as, relationship between copper concentration and caeruloplasmin activity.

Significant decrease ($P/ 0.01$) in blood serum copper concentration and caeruloplasmin activity were recorded in diseased ewes in comparison with control group, with non significant decrease in blood serum iron, calcium and inorganic phosphorus concentration.

The relationship of copper concentration to caeruloplasmin activity was described by the quadricetic equation.

$$Y = 61.29 \pm 0.979\ X$$

With regression coefficient ($r=0.973$) indicating strong correlation between them.

DISCUSSION

In ruminants a deficiency of copper causes interferance with tissue oxidation resulting in a wide range of clinical manifestations. In the present work, recorded clinical signs were those related to wool abnormalities, as loss colour (achromotrichia) in a feature of copper deficiency commonly seen in cattle and sheep (POOLE, 1963) and this is probably due to deficiency of the copper containing polyphenyl oxidase enzyme which catalyses the conversion of tyrosine to melanine. Moreover; loss of crimp and tensile strength wool occurs, because of failure to maintain normal disulfied groups used to provide cross linkages withen the wool fiber.

Concerning biochemical alterations, Table (1) and Fig. (1) recorded a significant decrease in both blood serum copper concentration and caeruloplasmin activity in diseased sheep with a mean values of 105.74±2.91 Ug% and 80.75±0.58 U/L, respectively. Non signifant decrease was showed in the concentration of blood serum iron, calcium and inorganic phosphrous.

In the present study, a highly significant correlation between blood serum copper level and blood serum caeruloplasmin activity was observed. The regression coefficient (r=0.973), indicated strong possitive correlation. Similar data for copper values in normal and diseased ewes were recorded by ABDEL-AZIZ (1979) and BLOOD, et al. (1983).

The explanation of low iron which is statistically non-significant based on the role of copper deficiancy in impairment of iron transfer to the plasma from reticuloendothelial system in the liver, depending on adequate amounts of coper-containing oxidative enzyme (caeruloplasmin). Anaemia has been reported as an important sign in hypocuprosis, and the severity of anaemia will be related to the hypocupremia, GARDNER (1976).

The diagnostic value of caeruloplasmin or paraphenylanediamine oxidase in blood had been assessed (SRIVASTAVA and DWARAKNATH, 1971) and coincide with the results of the present work, indicating that the caeruloplasmin activity is very closely related under field condition, to blood serum copper, and appears to offer little more than an alternative assay, particularly due to difficulty in obtaining uncontaminated samples and an estimating blood copper levels.

REFERENCES

Abdel-Aziz, H.M. (1979): Some studies on trace elements in some animal diseases. Ph.D. Thesis, Fac. Vet. Med., Zagazig University.

Blood, D.C.; Radostits, O.M.; Henderson, J.A.; Arundel, J.H. and Gay, C.C. (1983): Veterinary Medicine, A text book of the diseases of cattle sheep, pigs, goats and horses. 6th Ed. Bailliere tindall.

Dick, A.J.; D.W.; Gawthorne, J.M. (1975): Thiomolybdates and the copper-molybdenum-interaction in ruminants nutrition. J. Agric. Sci. Vol. 85, 567-568.

Fisk, C.H. and Subbarow, Y. (1925): The colorimetric determination of inorganic phosphorus. J. Biol. Chem.

Gardner, D.E. (1976): N.Z. Vet. J., 24, 117.

Gindler, E.M. and King, J.D. (1972): Rapid colorimetric determination of calcium in biological fluids with methyl thymol blue. J. Clinic. Path., 85, 376-382.

Kincaid, R.L.; Gay, C.C. and Krieger, R.I. (1986): Relationship of serum and plasma copper and caeruloplasmin concentrations of cattle and the effects of whole blood samples stroage. Amer. J. Vet. Res., Vol. 47, No. 5, pp. 1157-1159.

National Reseorch Council (1978): Nutrient requirment of dairy cattle. 5th Ed. Washirgton, D.C., National academy of Science.

Paynter, D.I. (1982): Differences between serum and plasma caeruloplasmin activities and copper concentrations.: Investigation of possible contributing factors. Aust. J. Biol. Science. 35: 353-361.

Piccardi, G.; Nyssen, M. and Dorche (1972): Colorimetric determination of serum iron without deprotenization in biologic fluids. J. Clin. Chem: Acta, 40, 219.

Poole, D.B.R. (1963): Copper deficiency in cattle: An investigation into copper deficiency in single suckled calves. M.V.Sc. thesis, Dublin Univ. pp. 88 Cited in Irish Vet. J. 36: 169-173 (1982).

Schosinsky, K.H.; Lehmann, H.P. and Bealer, M.F. (1974): Measurment of caeruloplasmin from its oxidase activity in serum by use of O-dianisidine dihydrorhloride. Clin. Chem., 20: 1556-1563.

Snedecor, G.W. and Cochran, W.G. (1980): Statistical methods. 6th Ed. Ames, Iowa state Univ. press, 149-210.

Sonnenwirth, A.C. and Jarett, L. (1980): Gradeuhals clinical laboratory Methods and Diagnosis. 8th Ed. st. louis, toranto, London.

Srivastava, K.B. and Dwaraknath, P.K. (1971): Ind. J. Animal Sci., 41, 471.

Suttle, N.F. (1974): Effects of Molybdenum and sulphur concentrations commonly found in ruminant diets on the availability of copper to sheep. In trace elements metabolism in animals New York Academic press. Inc. 612-614.

Underwood, E.J. (1977): Trace elements in human and animal nutrition. 4th Ed. New York Academic press.

Zak, B. (1958): Determination of serum copper. Clin. Chim. Acta. 3: 328.

Table (1)

Some biochemical alterations in Ewes suffering from copper dificiency

State	Blood constituents				
	Caeruloplasmin U/L	Copper Ug%	Iron Ug%	Calcium mg%	Phosphorus mg%
Control	104.38 ± 12.27	130.85 ± 8.42	98.87 ± 10.29	11.14 ± 1.08	4.34 ± 0.66
Diseased	80.75* ± 0.58	105.74* ± 2.91	88.00 ± 12.55	9.48 ± 0.59	3.87 ± 0.61

* Significant at P/ 0.01.

Fig.(I) The relationship between serum caeruloplasmin activity and serum copper concentration in sheep.